CLAIMS

1 - **MODULAR INFRARED IRRADIATION APPARATUS AND ITS CORRESPONDING MONITORING DEVICES**, the modular IR irradiation apparatus (1), more particularly directed to heat tranfer at elevated rates to a receiving substrate (L), as in industrial drying steps of paper and cellulose production; the modular IR irradiation apparatus (1) comprises a metallic frame or bed (2), which is designed to receive a number of irradiation modules (7), contaning primary plenum (3p) and secondary plenum (3s) distribution ducts which contain feeding outlet (3a) for the mixture of combustible gas and air (G) to the modules (7); characterized in that the modular IR irradiation apparatus (1) comprises :

- Mounting means which is explosion proof and blocks the bed (2) by means of side lower (LI) and upper (LS) metallic plates arranged in a laminar portion having angular flaps (18) fixed in side closing mirrors (19) and having further closing of bottom caps (6) having side flaps (6a) and closing flaps (22 and P1) and being engaged in an longitidunal latche (22) in the flap (18) of the lower plate (LI); the blind mirror (EC) and the instrument mirror (EI) having holes which are fitted to te devices to be fixed thereto;
- Constructing means for fixing the irradiation element (1) to the process via support tube (4) and locking bearing (M);
- Constructing means for housing, feeding, and combustible gas (G) distribution in the flexible refratory ceramic (15) modules (7) mounted transversally to the cavity (CR) of the bed (2);
- Mechanical means of pressurized sealing air admission (AS) in the mirror (EI) of the bed (2), pressurization of the inner cavity of the equipment, cooling the UV system and provide a venturi effect of the oxygen measuring means;
- Constructing means for side mouting and sealing (17) of the flexíveis refratoric ceramic (15) of the modules (7) and fixation of the ceramic thin housings (16) with elastomer (17);
- The flexible refractory ceramic (15) is maleable and have a porous feature related to the fibrous mass;

- Monitoring device of the thermal flow direction of the modules (7) by using sensors (14);
- Collecting and monitoring device of the smokes from the surface burning (D1) of the modules (7) by using oxygen measuring means (23) based on Zirconinum oxide;
- UV flame detection device (24) applied in th tube (4) positioned to the cavity (CR) and the surface (D1).

2 - **Apparatus**, according to claim 1, characterized in that the metallic sides (LS) are provided with alleviating and dilatation channels (AD).

3 - **Apparatus**, according to any one of claims 1 or 2, characterized in that each irradiation module (7) comprises a base receiver (8) having a feeding hole (11), each module (7) is fixed to the plena (3p, 3s) by means of screws and pins (P); the referred base (8) receives at its free edge a screen (12) having holes (12a) and in which lower face are fixed at least two set of thermal flow sensors (14) interconnected by the electronic circuit (13); such sensors (14) are interconnected to an electronic device (14a) which is connected to the LPC central; at the upper face of the referred screen (12) is positioned a porous flexible refractory ceramic plate (15) and its respective fixing means, side sealing (17) (S) in which lower median portion the sensors (14) are kept.

4 - **Apparatus**, according to claim 1, characterized in that the bed (2) internally receives rectangular support and distribution ducts, a primary plenum (3p) a secondary plenum (3s) which possesses a feeding tube (10) and outlets (3a) for feeding the modules (7) with combustible gas/air mixture (G) such ducts are aligned to holes (9) existing in each one of modules (7) directed to the secondary plenum (3s) or via modulation or blocking valve (VL) to the primary plenum (3p).

5 - **Apparatus**, according to claim 4, characterized in that the feeding hole (9) of each module (7) is positioned in relation to the surface called base (8).

6 - **Apparatus**, according to any one of the preceding claims, characterized in that the modules (7) can be coupled via feeding hole (9) to the primary plenum (3p) or to the secondary plenum (3s) by a 180° rotation position inversion of each module (7).

7 - **Apparatus**, according to any one of the preceding claims, characterized in that the modules can de framed in variable lenghts and widths.

8 - **Apparatus**, according to claim 3, characterized in that holes (12a) of th screen (12) have circular dimensions or other suited dimensions.

9 - **Apparatus**, according to claim 3 characterized in that thermal flow sensors (14) overpass the screen (12) until effect a deep contatct to the ceramic (15) where the sensors are fixed in one position under the line (Y).

10 - **Apparatus**, according to any one of the preceding claims, characterized in that the side stopping means (S) of each plate of flexible refractory ceramic are arranged for fit in thin ceramic housings (16) anchored at the side faces of the ceramic plate by an elastomer layer (17) which is able to penetrate in both parts (15, 16).

11 - **Apparatus**, according to claim10, characterized in that the sealing means (S) serves as anchoring means adhering to the parts (15, 16) and avoiding side dispersion (D) of the combustible gas/air mixture (G) entering in the ceramic plate (15) via screen holes (12a).

12 - **Apparatus**, according to claims 10 and 11, characterized in that the sealing means (S) of each one of ceramic plate (15) avoid a side burning zone (D) keeping the burning zone restricted to the face (D1) existing at the surface of the ceramic plate (15).

13 - **Apparatus**, according do claim 11, characterized in that block comprising the flexible refractory plate (15) and the thin ceramic housings (16) are fixed to the screen and to the base (8) by applying an elastomer layer (17) producing a flexible sealed junction which supports natural vibrations.

14 - **Apparatus**, according to any one of the preceding claims, characterized in that the elatomer (17) is high temperatures resistant.

15 - **Apparatus**, according to any one of the preceding claims, characterized in that the refractory ceramic plate is flexible and porous.

16 - **Apparatus**, according to claim 15, characterized in that the fiber fabric (F) of the ceramic plate (15) is kept free for movements (V) which can occur due to the forced passage of gas (G), permitting the movement for distribution of gas flow through the pores (R) of the fibrous estruture.

17 - **Apparatus**, according to claims 15 or 16, characterized in that the porous flexible refractory ceramic plate (15) permits modulation of the gas volume (G) and the emission power of the irradiation apparatus (1) keeping the rate of discharge in the active pores compatible with the combustion rate and keeping the emission temperature and the flame position stable at the first layers (D1) of the ceramic plate (15).

18 - **Apparatus**, according to any one of preceding claims, characterized in that the thermal flow sensor (14) is able to monitoring the thermal flow inversion at the ceramic plate (15), and keeping a maximum temperature differential at de median line (Y) in each ceramic plate.

19 – **Apparatus**, according to claim 18, characterized in that the sensors (14) are verified by the LPC which is the responsible for the temperature differential monitoring in each plate (15) and generates a gas bloclking alarms.

20 - **Apparatus**, according to any one of the preceding claims, characterized in that the oxygen measuring means (23) comprises a Zirconinum oxide based sensor (25) which is applied near to the burning zone (D1) and is able to monitoring and analyzing the amount of residual oxygen after the combustible burning; the sensor is connected to the LPC of the monitoring system.

21 - **Apparatus**, according to claim 20, characterized in that the oxygen measuring means (23) comprises a device having a temperature controlled chamber (26) formed by five tubular bodies (27, 28, 30, 31, 33) which are welded (29) one to the other, the set (23) is fixed by holders (34) at the side upper internal flap (LI), the tubular body (28) is fixed in one extension (31) which is able to form a venturi system joined the tubular body (30), the tube (30) have the greates diameter for conduct the pressurized sealing air from the bed (2) to outside, a collecting tip (35) is coupled to the upper edge of the tube (33) and it is provided with holes (36) at the lower position and with concentrating flaps (37).

22 - **Apparatus**, according to claims 20 and 21, characterized in that the collecting tip (35) is used by the differential lighting system as ground contact for discharge the trigger.

23 - **Apparatus**, according to any one of the preceding claims, characterized in that the UV flame detector (24) comprises an UV bulb sensor (39) encapsulated and protected (38) inside the cooling device (40) which extends to the collimation cavity of IR emission (CR) via ceramic tube (47); the UV sensors (24) are positioned at the external side of the instrument mirror (EI), more particularly fixed at the supports (44) by means of tubes (48) which serve to conduct pressurized sealing air inside the irradiation support tube (4) to the cooling body (40); the cooling body (40) comprises flaps (41) at its external face defining cooling channels for keeping the inner chamber (42) of the sensor housing (39) cool; such body also comprises an lower hole (43) coupled to the metallic box type support (44) through which the cooling air is conducted and the wires connecting the electronic monitoring part (flame relay); the ceramic protection tube (47), is fixed to the cooling body (40) to the flange (45) which possesses inner tips as retention means (46) of such tube (47).

24 - **Apparatus**, according to claim 23, characterized in that the UV flame detector (24) can be double mounted and being placed two flame detectors (24) to a single irradiation apparatus (1).

25 - **Apparatus**, according to claims 23 and 24, characterized in that the ceramic tube (47) restrains and protect the sight field of the bulb (39) against obstructions caused by vapor clouds from the process.